A constraint-based selection principle for the Standard Model gauge group, II: an anchored substrate, a channel-graded operator, and the parity chain

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July 2026 — draft v7

Abstract

This revision reports a foundational consolidation and its physics yield. The substrate of v6.1 has been displaced, by a pre-registered selection criterion, in favour of a strictly more parsimonious foundation built from a single primitive pair $(A, 0)$: variant something against an invariant reference, with structure growing as anchored chains. Three results are theorems of this foundation. (i) *Alphabet closure*: the roles available to a unit are exactly three (B, C, D), read off valence signatures — the threefold structure needed by a $\mathbb{Z}_3$ grading is derived, not postulated. (ii) *Unconditional orientation*: closure occurs only at the free end of an anchored chain, so every closed shell is absolutely oriented; across 12,683 shells in all reported runs the mirror multiplicity is zero ($\varepsilon = 1$), with no auxiliary commitment required. (iii) The count dynamics derives, as before, an unobservable monotone residue, a visible ± 1 oscillation, and annihilation-on-equalization, with the residue–annihilation identity exact in simulation (10,226 = 10,226). The transfer operator is now *channel-graded*: with grade = total open-chain length mod 3, closure is forced to decompose into exactly three graded channels; measured channel weights $(0.583, 0.281, 0.136)$ give a transfer identity residual of 2.2×10^{-16} and a Perron–Frobenius critical state ($\lambda_{\max} = 0.621$, gap 0.0062). We report with equal prominence a falsification that shaped this construction: a carry-based grading was pre-registered, tested at $n = 705$ events, falsified at $p \sim 10^{-10}$, and withdrawn. On geometry we sharpen v6.1's caution: at accessible sizes the substrate exhibits scale- and probe-dependent dimensionality (spectral ≈ 1.8 stable; ball dimension drifting through 3–3.6; distance scaling higher), placing the $d = 3$ conjecture unsupported as stated and locating the framework in the universality neighbourhood familiar from discrete quantum gravity. Finally, the parity chain of the no-go theorem is assembled to one open factor: the substrate is measured to be directionally active along its own orientation ($\alpha = 0.324$), and with oriented-shell density $n_s = 0.233$ and mode–shell overlap 0.755 (measured), the axial deformation evaluates to $\Upsilon_A \approx 0.15\, H$ under a flagged factorization ansatz and unit bare coupling — order-unity chiral discrimination per few Hubble times, which is the magnitude the selection mechanism requires; the sign, and the bare coupling, remain open.

*Independent researcher. Email: tmorg11@yahoo.com. ORCID: 0009-0006-6415-4051. Draft v7 for comment; supersedes v6.1 (Zenodo). Division of labor, stated plainly: the conceptual framework, its rules, and all foundational decisions are the author's; the formal derivations, proofs, and simulations were produced with substantial assistance from AI systems (Anthropic Claude), are verified numerically as stated in the text, and have not yet been independently checked by a human mathematician. Every claim is labelled at its registered strength (theorem / measured / conjecture / ansatz). Correspondence, criticism, and collaboration are welcome.

1 Introduction

The gauge group $SU(3) \times SU(2) \times U(1)$, the generation count, and weak-sector handedness are inputs to the Standard Model; this programme attempts to make them outputs of a discrete substrate. Version 6.1 of this work froze one candidate foundation and built its operator theory; the present revision records that a successor foundation defeated it on the pre-registered selection criterion and that the entire construction — integration, operator, theorems — was rebuilt on the winner, absorbing one triggered falsification en route. We continue to mark every claim as THEOREM, MEASURED, CONJECTURE/POSTULATE, or (new in this revision) ANSATZ, and we report negative results at the same prominence as positive ones.

2 The anchored foundation

2.1 Primitive and alphabet

The primitive is the pair $(A, 0)$: a variant something against an invariant reference, neither meaningful alone, their link invariant, all 0-facing states of A equivalent. Structure grows as chains of A's anchored on the reference; a unit's role is its valence signature: B (one A-link; free end), C (one A-link and the 0-link; anchored end, revertible), D (two A-links; interior).

Theorem 1 (Alphabet closure)**.** *Under linear expansion on the anchor, exactly the roles* $\{A^*, B, C, D\}$ *occur: open chains are* $B\,D^{n-2}C$ *and closed shells are* $C\,D^{n-2}C$*, for all* $n \geq 2$*. Verified exhaustively to* $n = 8$*.*

The threefold role structure required by the $\mathbb{Z}_3$ programme is thereby derived from position alone. The count dynamics of v6.1 carries over intact: totals are hidden and monotone (residue), differences walk ± 1 (oscillation), equalization annihilates (failure), locked shells are immune (permanence), failed units' neighbours re-knit; the residue–annihilation identity holds exactly in the integrated simulation (10,226 = 10,226 across three runs of 8,000 units).

2.2 Unconditional orientation

Theorem 2 (Orientation, $\varepsilon = 1$)**.** *Closure occurs only at the free (B) end of a chain; the anchor end is fixed. Hence every closed shell carries its* 0*-charge at the closure end and none at the root end: the mirror configuration is unconstructible.*

Verified with full dynamics: 7,102 shells (pre-integration) and 5,581 shells (integrated substrate), zero mirrors. Unlike its predecessor, this theorem requires no generative commitment: the invariant anchor alone fixes the orientation. The statistical companion is weaker and recorded as such: radial winding of formation edges within locked shells measures $\kappa_{\text{rad}} = 0.863$ (a downgrade from the predecessor's 0.931, mechanism identified as count-layer churn).

3 The channel-graded operator, and a falsification

A carry-based grading (shell size mod 3 with large shells as next-level seeds) was pre-registered with a falsification clause and tested at high statistics: vicinities of size-5+ shells are large-shell enriched ($\chi^2 \approx 50$, $p \sim 10^{-10}$, $n = 705$ carry events), the signature that falsifies seeding. The identification was withdrawn; the shell-size statistics are a single memoryless geometric law. The

surviving grading is forced rather than chosen: with grade = total open-chain length mod 3, extension and nucleation shift +1, reversion −1, and closure is forced to decompose into three graded channels by length class $(k-2)$ mod 3. Measured channel weights: $4349 : 2095 : 1011 \to w = (0.583, 0.281, 0.136)$.

Proposition 1. *On* 9,841 *history states the grade-decomposed transfer identity holds with maximum residual* 2.2×10^{-16}*; K has a real simple dominant eigenvalue* $\lambda_{\max} = 0.621$ *with modulus gap* 0.0062 *and entrywise-positive eigenvector, so the critical state exists.*

A fresh clause registered at the pivot — channel memorylessness — passes ($\chi^2 = 0.84$, $p = 0.93$, $n = 2{,}689$ vicinity-sequential pairs).

4 Classification and the parity no-go (carried)

The five-filter reduction of the Cartan catalogue, the Null theorem (the one-loop self-energies of the damped theory vanish identically), and the No-go theorem (a parity-even, chirality-blind Υ cannot distinguish $SU(2)_L$ from $SU(2)_R$ at any order) are foundation-independent and carry unchanged from v6.1. Any expansion-sourced parity selection requires an axial component Υ_A.

5 Geometry: scale-dependent dimensionality

At accessible sizes (ladders to 48,000 units on the predecessor and 16,000 on the present foundation) the substrate has no single dimension: spectral dimension is stable near 1.4–1.9; ball dimension drifts upward through 3–3.6 without plateau; global distance scaling reads higher. Both foundations land in the same class, suggesting the phenomenon belongs to the growth paradigm, not the primitive. The $d = 3$ conjecture is unsupported as stated; the honest reformulation routes (estimator-and-scale specification; asymptotic emergence; space as a derived structure) are open. The stable short-scale spectral dimension near 2 places the substrate in the universality neighbourhood reported across discrete quantum-gravity approaches — kinship, not vindication.

6 The parity chain

The substrate now supplies, all measured, the ingredients the axial mechanism needs: absolute orientation ($\varepsilon = 1$, theorem), radial alignment ($\kappa_{\text{rad}} = 0.863$), directional activity — formation events source from the anchored half of locked shells over the root half at 3,598 : 1,838, $\alpha = 0.324$ — oriented-shell density $n_s = 0.233$, and mode–shell overlap 0.755 (random-walk occupation of locked vertices, enhancement 1.15 over the static fraction). Under a factorization ANSATZ (flagged: each factor measured, the product form a modelling assumption pending the fermionic mode theory) and unit bare per-contact coupling (a normalization argument, not a derivation):

$$\frac{\Upsilon_A}{\Upsilon} = \varepsilon\, \kappa_{\text{rad}}\, |\alpha|\, n_s\, \hat{\lambda}_{\text{geo}} \;\approx\; 0.049, \qquad \Upsilon_A \approx 0.15\, H.$$

Accumulated over a few Hubble times this is an order-unity chiral discrimination — the magnitude the selection conjecture requires. Stated with equal weight: if the mode theory returns a bare coupling $\ll 1$, the mechanism is real but cosmologically feeble and the conjecture fails on

magnitude. The SIGN of Υ_A — which chirality survives — is localized entirely in the embedding step (whether graph orientation maps to spatial chirality), the same gap that carries the dimension question.

7 Predictions and open problems

Unchanged in kind, sharpened in status: no proton decay at any energy; three generations as grade sectors (an identification, still a postulate); an H-sign–handedness correlation whose magnitude is now estimated ($\Upsilon_A \approx 0.15\,H$ under the stated ansatz) and whose sign is open. Open problems in dependency order: (1) the bare per-contact coupling and the fermionic mode theory; (2) the sign (embedding); (3) the measure problem / dimensionality; (4) the rank bound; (5) amplitudes beyond the chain. The archive of falsified and withdrawn identifications is part of the record and, we believe, part of the argument.

A Numerical protocol

Growth: anchored chains with contextual nucleation, local cross-links (valence cap 6), full count dynamics (oscillation, annihilation with re-knitting and orphan rooting, permanence); sizes to 16,000 (present foundation) and 48,000 (predecessor); seed-averaged. Operator: sparse construction on 9,841 states; transfer residual by grade projection at $s = 0.98$; Arnoldi spectrum. Censuses: orientation 12,683 shells cumulative; carry-seed test $n = 705$ with controls; channel memorylessness $n = 2{,}689$; propagation asymmetry 5,436 events; walk occupation 6,000 walks. Code available from the author.

References

[1] R. Slansky, "Group theory for unified model building," Phys. Rep. **79** (1981) 1.

[2] S. Weinberg, *The Quantum Theory of Fields*, Vols. I–II, Cambridge University Press (1995–1996).

[3] N. D. Birrell and P. C. W. Davies, *Quantum Fields in Curved Space*, Cambridge University Press (1982).

[4] V. Berzi and V. Gorini, J. Math. Phys. **10** (1969) 1518; W. von Ignatowsky, Phys. Z. **11** (1910) 972.

[5] J. Ambjørn, J. Jurkiewicz and R. Loll, "Spectral dimension of the universe," Phys. Rev. Lett. **95** (2005) 171301.

[6] J. C. Pati and A. Salam, Phys. Rev. D **10** (1974) 275; R. N. Mohapatra and J. C. Pati, Phys. Rev. D **11** (1975) 566.

[7] T. Morgan, "A constraint-based selection principle for the Standard Model gauge group," Zenodo, v6.1 (2026).